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AQUATIC INVERTEBRATES AND HABITAT AT A FIXED STATION ON THE YELLOWSTONE RIVER, PARK COUNTY, MONTANA

July 23, 2001

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A report to
the Montana Department of Environmental Quality
Helena, Montana

by
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INTRODUCTION

This report is one of 38 brief interpretive summaries of data assembled as part of a statewide, multi-year study conducted by the Montana Department of Environmental Quality (MT DEQ). Each report discusses information generated from a single benthic invertebrate sample collection and habitat evaluation at a fixed station established on a gauged river or high-order tributary. The present treatise focuses on the aquatic community sampled on the Yellowstone River near Livingston, Montana on July 23, 2001. The sample site was located by GPS reading at 45° 35' 47" N, 110° 33' 58" W, lying within the Montana Valley and Foothill Prairie Ecoregion (Woods et al. 1998). The sample was collected by personnel of MT DEQ. Sampling effort consisted of either a composite of four Hess samples, or a one-minute kicknet collection (Bukantis 1998). Habitat parameters were evaluated using the MT DEQ Macroinvertebrate Habitat Assessment Field Form for streams with riffle/run prevalence. Invertebrate samples were processed and animals identified by Rhithron Associates, Inc. Analysis of invertebrate assemblages was accomplished by applying the revised method (Bollman 1998) for streams of Western Montana's ecoregions. The method uses a multimetric battery to evaluate disturbance to biotic integrity.

The revised bioassessment metric battery and its scoring criteria have not been evaluated for application to higher-order streams and rivers; to date, no bioassessment method has been contrived for these waterways in Montana. Thus, the method used here is likely to have limitations in its applicability to the sites in this study. Ninety-eight sites in Western Montana were used to assemble the revised metric battery and to test it for sensitivity in detecting impairment, to establish scoring criteria, and to improve robustness of bioassessment. These 98 sites were mainly second and third order streams; the sampling season roughly corresponded to that of the fixed-station study. Mean water temperature for these sites at the time of sampling was 15°C (median = 14°C).The sites sampled for the fixed stations study are quite different from these test streams. Twenty-five sites located in Western Montana were sampled between July 23 and August 25, 2001 for this study. All are riverine or high-order waterways. Mean water temperature for these sites at the time of sampling was 19.8°C (median = 19.4°). Temperatures ranged from 15.5°C (Kootenai River near Libby) to 25.3°C (Jefferson River near Three Forks). Natural variations in benthic community composition and structure along longitudinal and thermal gradients are well known phenomena. Thus, scores and classifications were established for much smaller systems with significantly lower water temperatures than those included in the fixed stations study group. Impairment classifications and use support designations in this study must be interpreted with care. Results from the application of other metric batteries may be found in the Appendix.

RESULTS AND DISCUSSION

Table 1 itemizes the nine evaluated habitat parameters and shows the assigned scores for each, as well as the integrated score and condition category.

Overall habitat conditions scored optimally at this site on the Yellowstone River. All instream habitat parameters were judged ideal. Streambanks were appraised as moderately stable, with some disruption of vegetative protection observed on both banks. The riparian zone width was perceived to be somewhat abbreviated.

Table 1. Stream and riparian habitat assessment for a fixed station on the Yellowstone River. July 2001.

Max possible score	Parameter	Yellowstone River near Livingston
10	Riffle development	9
10	Benthic substrate	9
20	Embeddedness	18
20	Channel alteration	15
20	Sediment deposition	17
20	Channel flow status	18
20	Bank stability: left / right	8 / 8
20	Bank vegetation: left / right	7 / 8
20	Vegetated zone: left / right	6 / 8
160	Total	131
	Percent of maximum CONDITION*	**82** **OPTIMAL**

*Condition categories: Optimal > 80% of maximum score; Sub-optimal 75 - 56%; Marginal 49 - 29%; Poor <23%. Adapted from Plafkin et al. 1998.

Table 2. Metric values, scores, and bioassessment for a fixed station on the Yellowstone River. The revised bioassessment metric battery (Bollman 1998) was used for the evaluation. July 2001.

	Yellowstone River near Livingston	
METRICS	**METRIC VALUES**	**METRIC SCORES**
Ephemeroptera richness	3	1
Plecoptera richness	1	1
Trichoptera richness	4	2
Number of sensitive taxa	0	0
Percent filterers	78.8	0
Percent tolerant taxa	1.8	3
	TOTAL SCORE (max.=18)	7
	PERCENT OF MAX.	**39**
	Impairment classification	**MODERATE**
	USE SUPPORT	**PARTIAL**

Bioassessment results are given in Table 2. When this bioassessment method is applied to these data, scores indicate that this site on the Yellowstone River is moderately impaired and only partially supports designated uses.

The low biotic index value (3.15) suggests that water quality at this site was good. Low mayfly taxa richness (3) appears to contradict this, however. The sample was dominated (51%) by the caddisfly *Brachycentrus occidentalis*, which confounds interpretation of the water quality indicators in the data in two ways. First, since *B. occidentalis* is assigned a low tolerance value (2), a biotic index value skewed toward this low number results. This metric can be rendered less reliable when its calculation is applied to samples in which a single taxon comprises half or more of organisms Second, the abundance of the caddisfly may have compromised habitat for mayfly taxa, which thus have become less abundant in number of organisms and less diverse in number of species for reasons unrelated to water quality. Other clues to water quality are not clear from the data; no sensitive taxa were collected, contrarily, the proportion of tolerant organisms was low.

Filter-feeding organisms comprised the largest component of the functional structure of the assemblage; nearly 80% of organisms in the sample were filter-feeders. Besides *B. occidentalis*, the other abundant filter-feeder was the midge *Rheotanytarsus* sp. Together, the midge and the caddisfly made up 77% of the sampled animals. This suggests that suspended organic material was copious. Other expected functional components were present in the sample, but none were abundant.

The low taxa richness may have been a consequence of monotonous habitat, but it seems more likely that it was due to simple exclusion by *B. occidentalis*. "Clingers", including *B. occidentalis*, comprised 69% of organisms collected; although the "clinger" fauna was not rich in taxa, their abundance suggests that fine sediment deposition did not compromise hard substrate surfaces.

CONCLUSIONS

- Large amounts of suspended organic particulates appear to be indicated by the dominance of filter-feeders among the functional components of the benthic fauna at this site.
- Water quality indicators give equivocal results in this data, but water quality was likely good at this site.
- Instream habitats were probably unaffected by fine sediment deposition, since "clingers" were prolific.
- The bioassessment method used appears to have assigned an incongruous impairment classification to this site, given the tolerance characteristics of the benthic fauna. Slight impairment seems to be indicated

LITERATURE CITED

Bollman, W. 1998. Improving Stream Bioassessment Methods for the Montana Valleys and Foothill Prairies Ecoregion. Master's (M.S.) Thesis. University of Montana. Missoula. Montana.

Bukantis, R. 1998. Rapid bioassessment macroinvertebrate protocols: Sampling and sample analysis SOP's. Working draft. April 22, 1997. Montana Department of Environmental Quality. Planning Prevention and Assistance Division. Helena. Montana.

Woods, A.J., Omernik, J. M. Nesser, J.A., Shelden, J., and Azevedo, S. H. 1999. Ecoregions of Montana. (Color poster with map, descriptive text, summary tables, and photographs): Reston, Virginia. US Geological Survey.

APPENDIX

Taxonomic data and summaries

Yellowstone River

July 2001

Aquatic Invertebrate Taxonomic Data

Site Name: Yellowstone River near Livingston **Date: 7/23/01**
Site ID: Y03YELLR01 Approx. percent of sample used 3

Taxon	**Quantity**	**Percent**	**HBI**	**FFG**
Baetis tricaudatus	4	1.19	4	CG
Ephemerella inermis infrequens	3	0.90	4	CG
Tricorythodes minutus	1	0.30	4	CG
Total Ephemeroptera	**8**	**2.39**		
Claassenia sabulosa	1	0.30	3	PR
Total Plecoptera	**1**	**0.30**		
Arctopsyche grandis	14	4.18	2	PR
Brachycentrus occidentalis	171	51.04	2	CF
Glossosoma sp.	29	8.66	0	SC
Hydropsyche sp.	7	2.09	5	CF
Total Trichoptera	**221**	**65.97**		
Optioservus sp.	1	0.30	5	SC
Total Coleoptera	**1**	**0.30**		
Chelifera sp.	8	2.39	5	PR
Antocha sp.	1	0.30	3	CG
Total Diptera	**9**	**2.69**		
Polypedilum sp.	5	1.49	6	SH
Rheotanytarsus sp.	86	25.67	6	CF
Tvetenia sp.	4	1.19	5	CG
Total Chironomidae	**95**	**28.36**		
Grand Total	**335**	**100.00**		

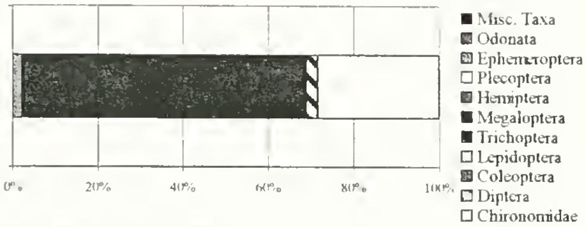
Aquatic Invertebrate Summary

Site Name: Yellowstone River near Livingston **Date: 7/23/01**

SAMPLE TOTAL	335
EPT abundance	230
TAXA RICHNESS	14
Number EPT taxa	8
Percent EPT	68.66

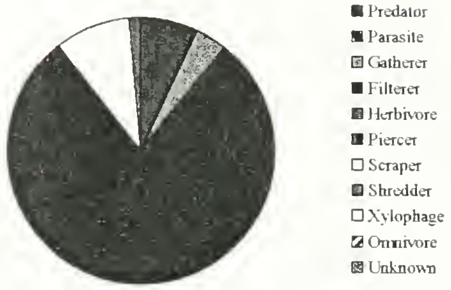
TAXONOMIC COMPOSITION

GROUP	PERCENT	#TAXA	ABUNDANCE
Misc. Taxa	0.00	0	0
Odonata	0.00	0	0
Ephemeroptera	2.39	3	8
Plecoptera	0.30	1	1
Hemiptera	0.00	0	0
Megaloptera	0.00	0	0
Trichoptera	65.97	4	221
Lepidoptera	0.00	0	0
Coleoptera	0.30	1	1
Diptera	2.69	2	9
Chironomidae	28.36	3	95



FUNCTIONAL COMPOSITION

GROUP	PERCENT	#TAXA	ABUNDANCE
Predator	6.87	3	23
Parasite	0.00	0	0
Gatherer	3.88	5	13
Filterer	78.81	3	264
Herbivore	0.00	0	0
Piercer	0.00	0	0
Scraper	8.96	2	30
Shredder	1.49	1	5
Xylophage	0.00	0	0
Omnivore	0.00	0	0
Unknown	0.00	0	0



COMMUNITY TOLERANCES

Sediment tolerant taxa	2
Percent sediment tolerant	0.60
Sediment sensitive taxa	2
Percent sediment sensitive	12.84
Metals tolerance index (McGuire)	2.52
Cold stenotherm taxa	0
Percent cold stenotherms	0.00

Site ID: Y03YELLR01

DOMINANCE

TAXON	ABUNDANCE	PERCENT
Brachycentrus occidentalis	171	51.04
Rheotanytarsus sp	86	25.67
Glossosoma sp	29	8.66
Arctopsyche grandis	14	4.18
Chelifera sp	8	2.39
SUBTOTAL 5 DOMINANTS	308	91.94
Hydropsyche sp	7	2.09
Polypedilum sp	5	1.49
Baetis tricaudatus	4	1.19
Tvetenia sp	4	1.19
Ephemerella inermis/infrequens	3	0.90
TOTAL DOMINANTS	331	98.81

SAPROBITY

Hilsenhoff Biotic Index	3.15

DIVERSITY

Shannon H (loge)	1.49
Shannon H (log2)	2.15
Simpson D	0.34

VOLTINISM

TYPE	ABUNDANCE	PERCENT
Multivoltine	76	22.69
Univoltine	72	21.49
Semivoltine	187	55.82

TAXA CHARACTERS

	#TAXA	ABUNDANCE	PERCENT
Tolerant	3	6	1.79
Intolerant	0	0	0.00
Clinger	8	231	68.96

BIOASSESSMENT INDICES

B-IBI (Karr et al.)

METRIC	VALUE		SCORE	
Taxa richness	14		1	
E richness	3		1	
P richness	1		1	
T richness	4		1	
Long-lived	0		1	
Sensitive richness	0		1	
%tolerant	1.79		5	
%predators	6.87		1	
Clinger richness	8		1	
%dominance (3)	85.37		1	
		TOTAL SCORE	14	28 %

MONTANA DEQ METRICS (Bukantis 1998)

METRIC	VALUE	Plains Ecoregions	Valleys and Foothills	Mountain Ecoregions
Taxa richness	14	1	1	0
EPT richness	8	2	0	0
Biotic Index	3.15	3	3	2
%Dominant taxon	51.04	1	0	0
%Collectors	82.69	1	1	0
%EPT	68.66	3	3	2
Shannon Diversity	2.15	1		
%Scrapers +Shredd	10.45	1	1	0
Predator taxa	3	1		
%Multivoltine	22.69	3		
%H of T	3		3	
TOTAL SCORES		17	12	4
PERCENT OF MAXIMUM		56.67	50.00	19.05
IMPAIRMENT CLASS		SLIGHT	MODERATE	SEVERE

Montana DEQ metric batteries